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I, KIM MARSHALL, MANAGER EXAMINATION SUPPORT AND SALES, hereby certify that the annexed is a true copy of the Provisional specification in connection with Application No. PP 2898 for a patent by UNIPANEL PTY LTD filed on 9 April 1998.

WITNESS my hand this Twenty-eighth day of April 1999

KIM MARSHALL
MANAGER EXAMINATION SUPPORT AND SALES

P/00/009
Regulation 3.2

COMMONWEALTH OF AUSTRALIA

Patents Act 1990

Australian Provisional Patent Application

APPLICANT: UNIPANEL PTY LTD

INVENTION TITLE: A BUILDING PANEL

The invention is described in the following statement:

A BUILDING PANEL

The present invention relates to a building panel. The invention has been developed especially, but not exclusively for use in interior wall or ceiling panelling, and the invention is herein described in that context. However it is to be appreciated that the invention has broader application and is not limited to that particular use. For example, the invention may be used in flooring or the like.

In the building industry, panels are widely used in interior walls, partitions and ceilings. One of the most common type of paneling used is plasterboard, which traditionally is formed from a core of gypsum or anhydrite plaster, faced with two sheets of heavy paper. Plasterboard has gained widespread acceptance because it is inexpensive, relatively light weight, can be easily cut and provides a good surface finish.

However, there are significant problems with plasterboard. Traditional plasterboard panels are not self supporting and need to be fixed to a supporting frame such as a stud wall or the like. This substantially increases the cost of installation. Furthermore, plasterboard has relatively poor thermal and acoustic insulation properties as compared to block walls, and is relatively inflexible thereby making it difficult to form into complex shapes.

Various proposals have been made to address these problems. These include the development of hollow core reinforced plaster panels or prefabricated sandwich panels made from two sheets of plasterboard bonded to a paper honeycomb core. Whilst such designs are self supporting, they have limited applications and have not gained widespread acceptance.

An aim of the present invention is to provide a building panel which is similar to traditional plasterboard panels in both terms of its costs and surface characteristics, yet which is able to provide significant improvements in respect of its structural properties.

According to the present invention, there is provided a building panel which includes a metal sheet substrate and a paper covering bonded to the substrate.

The panel according to the present invention provides significant advantages over plasterboard panels. The panel of the invention with its paper covering, has a surface characteristic which can match that of plasterboard, yet offers significant improvements in structural properties because of the metal substrate. For example, the panel can be load bearing, can be formed or otherwise shaped into complex configurations, and is able to exhibit improved thermal and acoustic insulation characteristics.

A particular advantage of the panel is that the surface of a wall formed from the panels can be finished to appear continuous using standard techniques used on plasterboard walls. Such techniques include plaster rendering and the use of plaster tape.

Throughout the specification the term "paper" includes sheet material formed from any fibrous material produced from either naturally occurring or synthetic fibres. The sheet material may be of unitary or composite construction. It also includes other types of sheet material which have characteristics, in particular surface texture, which are similiar to paper.

In a particularly preferred form, the panel of the invention is formed in continuous lengths using a laminating process to adhere the paper covering to the metal substrate. The production of panels in this way provides significant cost benefit and also has the advantage of enabling panels of indefinite length to be produced.

Preferably the panel includes longitudinal edges which are profiled. These profiles may be incorporated to allow the panel to be interconnected with like panels, or associated componentry such as fixing rails, edge trim or the like. The profiled edges may also be designed to allow the panel to interconnect with a traditional plasterboard panel so that the panel of the invention can easily be used in conjunction with these traditional plasterboard panels. In addition the panel may be profiled to enhance its load bearing characteristics. These strengthening profiles may be included at the longitudinal edges, or additionally could be incorporated mid span in the form of ribs or corrugations or similar structure. The profiles may be formed in the panel using any known technique such as roll forming, folding or the like.

However in a particularly preferred form, the panels are roll formed to the desired profile. In this way this forming step can be easily included as an extension to the laminating process.

Any appropriate sheet metal may be used as the substrate, such as steel, aluminium, tin or the like. In general construction, galvanised steel has wide application as the metal substrate as it is relatively inexpensive, has good structural properties and is corrosive resistant. The gauge of the metal substrate may be chosen depending on the required structural properties of the panel. However it is envisaged that the gauge will be between 0.3 to 1mm in most applications. Metal falling within this range of thicknesses can easily be cut thereby enabling services to be easily installed in the panel on site.

In a particularly preferred form, the panel is bonded directly to the metal surface. Preferably a reactive hot melt adhesive is used to bond the paper to the metal substrate. An advantage of using a hot reactive melt adhesive is that it provides high bond strength including high initial adhesive and cohesive strength which makes it ideal for laminating the paper directly onto the bare metal substrate. The ability to bond the paper directly onto a metal substrate again provides significant cost benefit in that it avoids the need for pretreatment of the metal such as the application of a primer coat to the metal surface. However, it is to be appreciated that intermediate layers such as paint or waterproof coatings may be included between the metal substrate and the paper covering if required.

In a preferred form, the adhesive is applied by a roller to the metal surface, as this gives good even coverage of the adhesive across the substrate surface which is important for providing an even surface finish on the panel.

The building panel of the invention has widespread application and can be used instead of, or in conjunction with, traditional paneling such as plasterboard. For example, the paneling of the invention may be used as a fascia, a ceiling panel or the like. In addition it may be used in conjunction with a traditional plasterboard partition or wall. For example, the panel may be included in a section of a plasterboard wall where a complex surface, such as a

curved wall, is required which could not be formed using conventional plasterboard.

The building panel may also incorporate additional layers to improve its structural properties. For example, the panel may include additional insulating or thermal layers bonded to the metal substrate on the opposite surface to the paper covering. Again these additional layers may be bonded using any known technique but are preferably applied using a laminating process so as to be easily incorporated in the overall forming process of the panel.

In a particularly preferred form, the building panel is incorporated as part of an integrated structural panel. In this arrangement, the structural panel includes spaced sheet structures which are interconnected by a core and wherein at least one of the sheet structures includes a building panel as described above with the paper covering forming an outer surface of the structural panel.

A structural panel according to this arrangement has widespread application for use as interior walls or partitions. The structural panel is self supporting, is able to be configured to be load bearing and can incorporate profiled edge regions to enable the structural panel to be interlocked with adjacent panels.

In a preferred form, both the sheet structures of the panel are formed at least partially from a metal sheet. If only one side of the panel is to be exposed, then only the exposed face need include the covering; the other face may remain bare metal. If both sides are to be viewed then both faces can include the paper covering. Alternatively, if required, different surface finishes may be used. For example, one surface may include a plastic or similar water impermeable covering for use in a bathroom or the like while the other face may include the paper covering. If required, one face may include a decorative surface such as a timber veneer or the like.

A particular advantage of using the building panel as part of an integrated panel is that the longitudinal edges can be formed so as to enable the panel to interlock with adjacent panels thereby facilitating the construction of a wall using the structural panels. The profile of the longitudinal edges of the

structural panel may be such that no additional fasteners are required. Alternatively, the edge profiles may be designed solely to align the adjacent panels and mechanical fasteners such a rivets, screws or inserts are used to fasten the panels together.

The core of the integrated panel may be of any suitable form depending on the application or requirements of the structural panel. In particular, the core may be of solid construction of may be of open form including interconnecting webs to thereby form cavities within the core. These cavities may be used to reduce the weight of the integrated panel or to provide passage for services such as wiring and the like.

In one form, the edge profiles are designed to be able to receive a structural member between adjacent panels. The structural member improves the load bearing capability of the wall and preferably comprises a metal beam.

In a particularly preferred form, the metal beam is contained within the connection between the adjacent panels so that it is fully concealed. In this way, a wall formed from the panels may be continuous across the join which contains the reinforcing beam.

In a further aspect, the present invention relates to a building panel including spaced sheet structures interconnected by a core, the panel including longitudinal edge regions which are profiled to enable the panel to be connected in abutting relationship with a like panel in edge to edge relationship, and wherein the abutting panels form a cavity therein which is adapted to receive a reinforcing bar to improve the load bearing characteristics of the abutting panels.

It is convenient to hereinafter describe embodiments of the present invention with reference to the accompanying drawings. It is to be appreciated however that the particularity of the drawings and the related description is to be understood as not limiting the preceding broad description of the invention.

In the drawings;

Figure 1 is a perspective view of a panel according to an embodiment of the invention;

Figure 1A is a detailed view to an enlarged scale illustrating the construction of the panel of Figure 1;

Figure 2 is a perspective view illustrating the panel of Figure 1 used as a ceiling panel when in position;

Figure 3 is a perspective view of a structural panel according to an embodiment of the invention;

Figure 3A is a detailed view to an enlarged scale illustrating the construction of the panel of Figure 3;

Figure 4 is an exploded perspective view illustrating the connection of the panel of Figure 3 with a like panel;

Figure 5 is a cross sectional view of the connection of the panel of Figure 3 with a like panel.

Figure 6 is a perspective view illustrating the connection of a variation of the panel of Figure 3 with a like panel and including an intermediate stiffening beam;

Figure 7 illustrates a variation of the panel of Figure 3 and its connection with a like panel;

Figure 8 is a partial perspective view illustrating the connection of an end trim component to the panel of Figure 7; and

Figure 9 is a line diagram of a laminating process for use in the production of a building panel.

Figure 1 illustrates a building panel 10 which is generally planar and includes opposite major surfaces 11 and 12 interconnected by edge regions 13 and 14.

The panel 10 is of composite material and formed from a laminating process which forms the panel in continuous lengths. The panel may be of any desired width, although if made from one sheet, the width will be limited by the width of the feed stock. In one form, the panel is formed in standard widths of 1200mm, 900mm, 600mm and 300mm.

The panel includes a metal substrate 15 and a paper covering 16 which is bonded to the substrate 15 by a reactive hot melt adhesive 17. The covering 16 constitutes a heavy plasterboard paper so that the outer face 11 of

the panel has the same general appearance and surface characteristics of a plasterboard panel. In the illustrated form, the substrate 15 is formed of galvanised steel thereby enabling the inner surface 12, which in use is concealed, to remain exposed due to its corrosive resistant properties.

The edge regions 13 and 14 of the panel are profiled so as to enable the panel 10 to be connected at these edge regions to a like panel. In the illustrated form, the profiles on the edge regions 13 and 14 are formed by roll forming the metal substrate 13. The edge regions 13 and 14 are formed with one edge region 13 forming a female coupling which is adapted to receive and contain the other edge region 14 which is formed as a male coupling. With this arrangement, the male edge region 14 locates in and is retained within a seat 15 formed within the female edge region 13 of a like panel so that the adjacent panels can be interconnected along their edge regions.

It is to be appreciated that the profiles formed in the edge regions 13 and 14 may take different embodiments as will be appreciated to those skilled in the art of roll forming techniques. Specifically, the profiles can be matched to suit the particular requirements of the panel and the mode of connection required between adjacent panels. For instance, the profiles may be designed such as those illustrated, to not require the addition of any mechanical fasteners to interconnect like panels together. Alternatively the edge regions could be formed so as to provide formations to receive specific mechanical fasteners such as rivets or screws or the like.

Figure 2 illustrates the panel 10 in place as part of a ceiling with the panel 10 aligned, and fixed to, the underside of parallel roof batons 60. In the illustrated form, the batons incorporate clips which are adapted to engage and hold the edge regions 13 and 14 of the panels. In this arrangement, the ceiling panels are installed progressively across the baton. A first panel 10^{i} is installed and fastened to the clips 61. A second panel 10^{ii} is then installed by locating the male edge region 14^{ii} within the female edge region 13^{i} of the affixed panel 10^{i} whilst the panel 10^{ii} is inclined relative to the fixed panel 10^{i}. Once located in place, the panel 10^{ii} is then swung up into alignment with the panel 10^{i} wherein its female edge region 13^{i} engages with associated clips 61

attached to the batons. The process then continues until all the panels are in place.

With this arrangement, the fixed panels 10 have respective outer faces which incorporate the plasterboard paper covering and thereby have a general appearance of plasterboard. If required, edge trim (not shown) can be inserted between the adjacent panels. Typically the panels would include a bead or similar protrusion which locates within an associated groove (not shown) formed in the edge regions 13 and 14 of the respective panels. Alternatively, the join between the panels could be concealed so that the ceiling surface is continuous using standard finishing techniques such as plaster rendering or the like.

Figure 3 illustrates a building panel 20 according to a second embodiment of the invention. The panel 20 is of sandwich construction incorporating first and second spaced structures 21 and 22 respectively, which are interconnected by a core 23. The panel 20 further includes edge regions 24 and 25 which are profiled to enable the panel 20 to be interconnected to a like panel.

As best illustrated in Figure 3A, each of the sheet structures 21 and 22 incorporate a structure which is similar to the panel 10 illustrated above. Specifically the panels 21 and 22 incorporate a metal sheet substrate 26 which includes a covering 27 formed from heavy plasterboard paper which is bonded to an outer surface 28 of the metal substrate 26 by a reactive hot melt adhesive 29. Similarly, an inner face 30 of the metal substrate 26 is bonded to the core 23 by a similar adhesive 31. The longitudinal edge regions 24 and 25 are profiled by roll forming the respective edge regions of the metal substrates 26 of the respective sheet structures 22 and 21.

The core 23 of the panel is illustrated as a foam block. However it is to be appreciated that the core may be formed of any suitable structure depending on the application of the panel 20. For example, the core may be formed from a composite construction and/or may include cavities or channels if desired.

In a similar manner to the earlier described embodiment, the panel 20 is formed from a laminating process. Typically the sheet structures 21 and 22 are

formed in a first laminating process. The sheet structures then form part of a second laminating process where they are bonded to the core. If desired, additional layers can be bonded to the panels to further improve the structural properties of the panel 20. For example additional layers may be incorporated to further increase the thermal or acoustic insulation properties of the panel. By virtue of the laminating process, the panels 20 are formed in continuous lengths and are typically formed in a range of standard widths such as 1200mm, 900mm, 600mm and 300mm.

The panel 20 has the general appearance and surface characteristics of plasterboard by virtue of the heavy paper covering 27. However because of its sandwich construction and sheet metal substrate, the panel 20 is lightweight, yet is self supporting and capable of acting as a load bearing member.

The edge region 24 of the panel 20 is roll formed to include a longitudinally extending projection 32 and recess 33 which are located intermediate the opposite faces 38, 39 of the panel 20. In the illustrated form, the projection 32 is formed from roll forming the edge of the structure 21 whereas the recess is formed from roll forming the edge region of the structure 22. An abutment face 34 is located between the face 38 and projection 32 and a similar abutment face 35 is formed between the projection 33 and the face 39.

Both the projection 32 and the recess 33 are shaped to be complementary such that the projection 32 is able to be received within the recess 33 of a like panel. To facilitate interconnection of adjacent panels, both the projections and the recesses include tapered surfaces to provide adequate lead in.

The other longitudinal edge region 25 of the panel 20 includes a similar edge profile and includes both a recess 32 and a projection 33, with the exception that the projection is formed from roll forming the edge of the sheet structure 22 whereas the recess 33 is formed from roll forming the edge region 21.

The panel 20 is arranged to be self supporting and typically arranged to be installed between top and bottom rails (not shown) which are formed as C-shaped channels or the like.

Figures 4 and 5 illustrate the connection of the panel 20 with a like panel. For ease of identification, one panel is designated 20^{i} whereas the other panel is designated 20^{ii}. Other features of the panels are distinguished in a similar manner.

As best illustrated in Figure 5, the edge regions 24^{i} and 25^{ii} enable two panels 20^{i} 20^{ii} to be connected in edge to edge relationship with the respective projections and recesses of the edge region 24^{i} engaging with the respective projections and recesses of the edge region 25^{ii} of adjacent panel 20^{ii}. Furthermore, the abutment surfaces 34^{i} and 35^{ii} engage so as to form a simple linear join 36 between the abutting panels 20^{i} and 20^{ii}.

In the illustrated form, both the longitudinal edge regions 24 and 25 of the panel is slightly waisted to form a recessed portion 37 in the outer surface of both the structures 21 and 22. This recess is designed to enable the join 36 between adjacent panels to be easily covered over by plaster tape or plaster rendering which will be applied within this recess and create a flush surface across the join.

The profile of the edge regions 24 and 25 also enables the panel 20 to be easily used in conjunction with standard plasterboard panels. Specifically, the abutment surfaces 34 and 35 provide a space to enable a plasterboard panel to be located in abutting relationship with the panel 20. The abutment surfaces 34 and 35 are dimentioned to be slightly larger than a standard plasterboard panel which is typically 10mm or 13mm, so as to provide adequate clearance for the plasterboard panel to be located outside the projection 32 and the recess 33 so that the plasterboard surface can be flush with the respective faces 38 and 39 of the panel 20.

The coupling arrangement to join adjacent panels using the interfitting projections and recesses 32 and 33 provide an area of load bearing strength at the engaged edge regions. This has significant advantage as it improves the load bearing characteristics of the wall formed by the adjacent panels. In most

applications, the interconnection of the panels gives the wall sufficient load bearing characteristics. If, however, additional load bearing strength is required in the constructed wall using the panels 20, a metal beam 40 may be incorporated at the connection. One such example is illustrated in Figure 6 where the beam is formed from roll formed metal sheet 41 and incorporates oppositely disposed channels 42 and 43 which are arranged to interfit between the engaging projections and recesses (32 and 34) of the adjacent panels 20^{i} and 20^{ii}. The beam 40 substantially improves the load bearing characteristics of the wall as, by virtue of its configuration and its engagement with the adjacent panels, it is able to accommodate substantial compressive loading.

Figure 7 illustrates a variation of the coupling arrangement between adjacent panels 20^{i} and 20^{ii}. In this arrangement both the longitudinal edge regions 24 and 25 incorporate a pair of recesses 33. As illustrated in Figure 7 in connecting the panel 20^{i} to like panel 20^{ii}, the recesses 33^{i}, 33^{ii} of the respective panels are arranged to be aligned and inserts 44 are located within the cavity formed between the aligned recesses to couple the panels together. The inserts may be of any suitable form and may include a continuous strip 45 which extends over the majority of the length of the connected panels, or may be in the form of smaller wedges 46 which extends over only a portion of the length of the panels.

Figure 8 illustrates a specially formed edge strip 50 which is arranged to be coupled to the longitudinal edge region 24 or 25 of the panel 20. The edge strip 50 may be solely as a decorative end strip or may have a functional purpose such as form part of a door frame assembly as in the illustrated embodiment where the strip 50 is configured to form a door jamb.

Figure 9 illustrates a line diagram of a laminating process used to bond the paper covering to the metal substrate for use in the building panel of the invention.

In this process, the metal feed stock 26 which is typically galvanised steel but may be any other sheet metal, is fed from an uncoiler 101 into the process line 100. The sheet metal is then correctly positioned by running through an edge guide 102 and then subsequently through a straightener 103.

The sheet metal then passes through a cleaning and heating unit to remove any debris on the metal surface and to bring the temperature up to a predetermined level. The exact temperature range used is dependent on the characteristics of the adhesive being applied but is typically in the range of 20 to 50°C. The sheet metal then passes through to an adhesive coater 105 which incorporates a roller 106 which comes into contact with the upper surface 28 of metal substrate 26 so as to apply a thin film to the metal sheet. The adhesive is a reactive hot melt polyurethane and is typically applied at a temperature in the range of typically 110 to 140°C with a coating being applied to the metal surface in the order of 10-20 microns in thickness.

After the adhesive has been applied, the metal sheet 26 then passes through a humidifier 107 which further conditions the adhesive coating on the metal surface 28. The sheet then passes to a laminator 108 where the paper 27 which is stored in a coil 109 is applied under tension to the surface 28 of the metal 26. The laminated product is then fed to a recoiler wherein it is stored in rolls ready for transporting (as illustrated) or to a further production station. The station further processes the metal panel and may include a roll forming station to form the edge profiles, a sheering station to form the panel into sheet form or to slit the metal panel so as to alter the panel width. To make the integrated building panel 20, the laminated metal sheet is fed to a separate laminating process to form the panel 20 with its sandwich construction.

An advantage of the panel of the present invention is that the paper laminated metal sheet is inexpensive to manufacture as it can be made using the laminating process without requiring any pretreatment, such as painting of the metal substrate. This has substantial practical benefit as it enables the building panel formed from the metal substrate to be extremely competitive in price with traditional plasterboard panels. Furthermore by making the building panel using the composite material of a metal sheet substrate and a paper covering, the panel of the invention can be used in conjunction with plasterboard panels, as it has a surface characteristic which can match that of plasterboard, yet has the additional advantages in that it can be load bearing, can be formed or otherwise shaped into complex configurations, including

being able to have profiled edges to enable the panel to be interlocked with a like panel and can be designed to have improved thermal and acoustic insulation characteristics.

Finally it is to be understood that modifications and or additions may be made to the parts as previously described without departing from the spirit or ambit of the invention.

DATED: 9 April, 1998

PHILLIPS ORMONDE & FITZPATRICK
Attorneys for
UNIPANEL PTY LTD

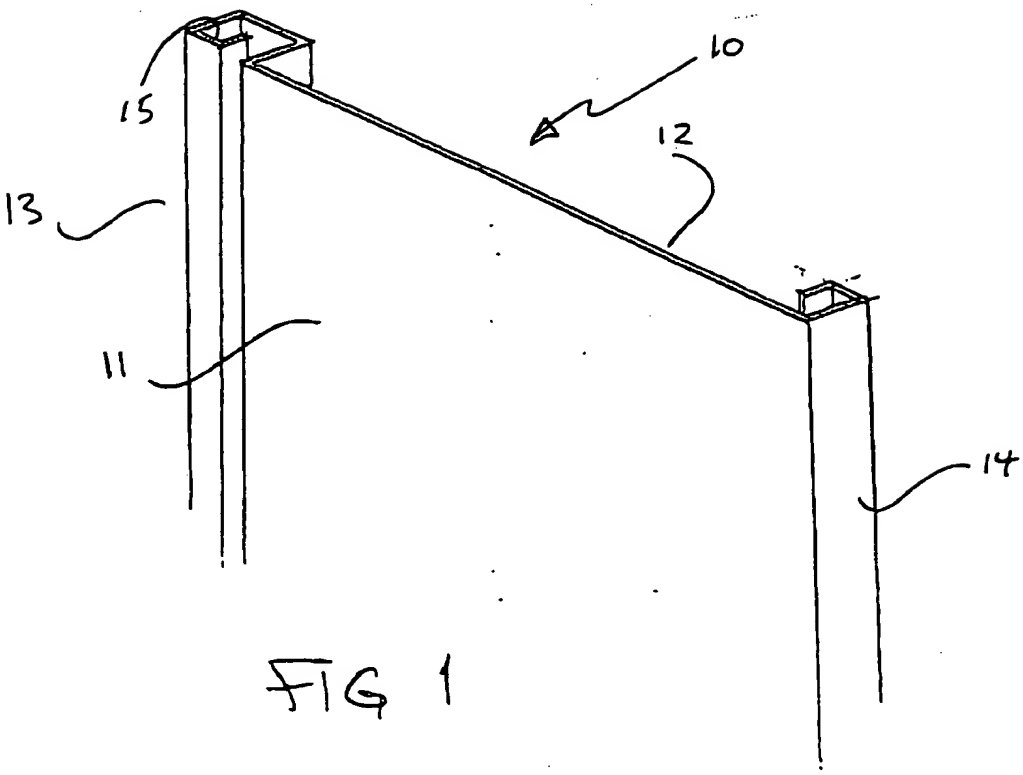


FIG 1

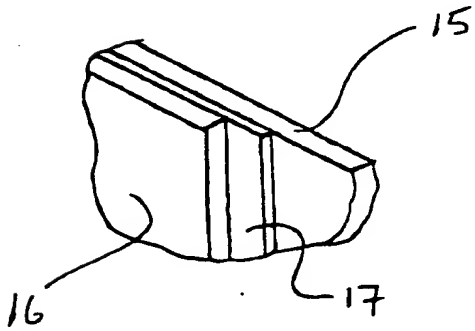


FIG 1A

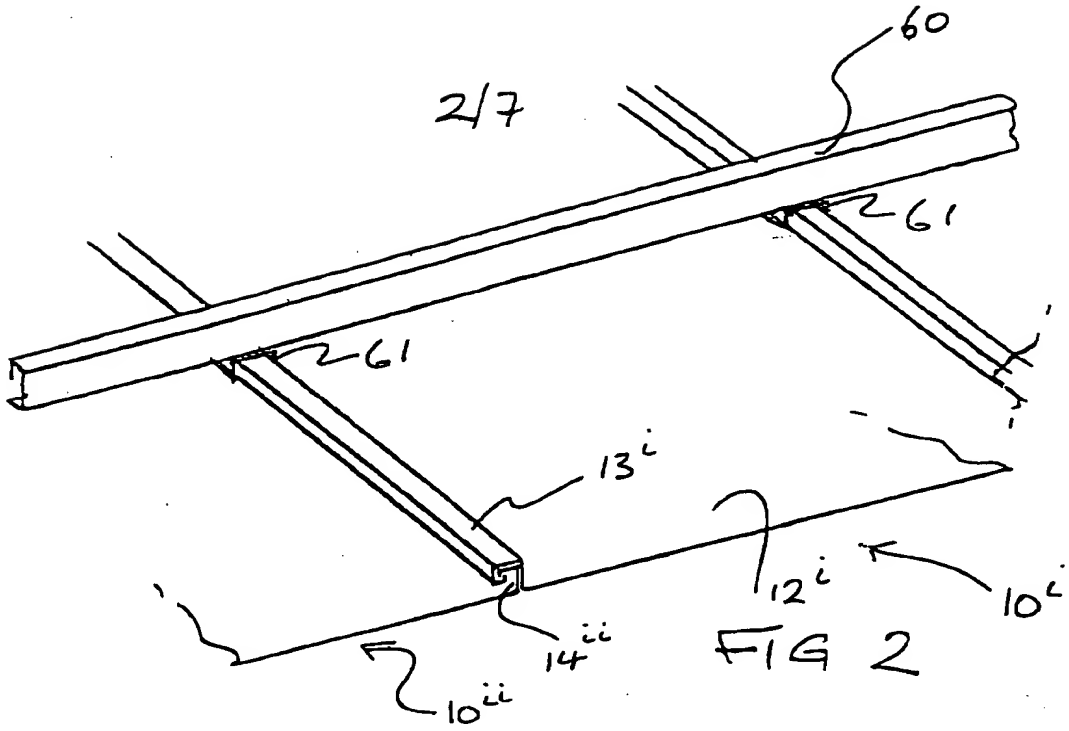


FIG 2

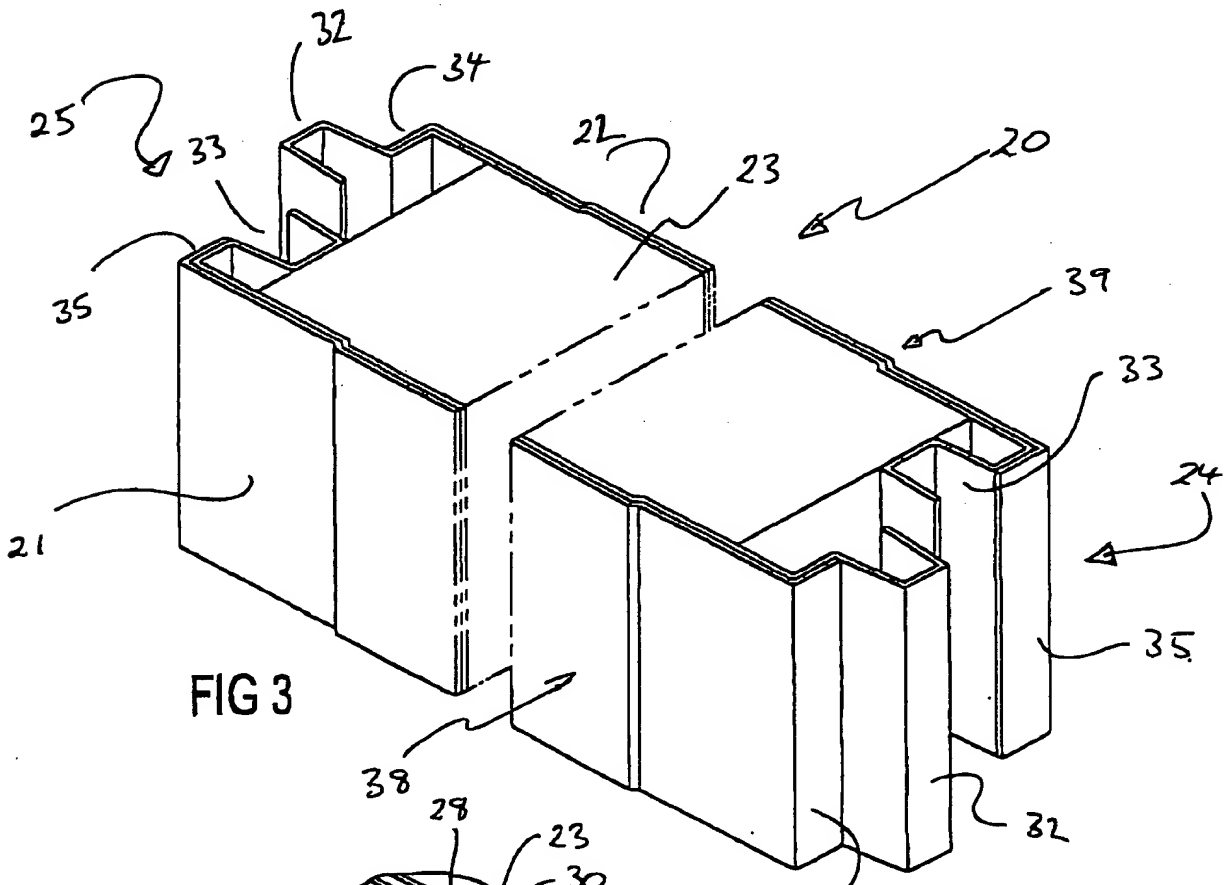


FIG 3

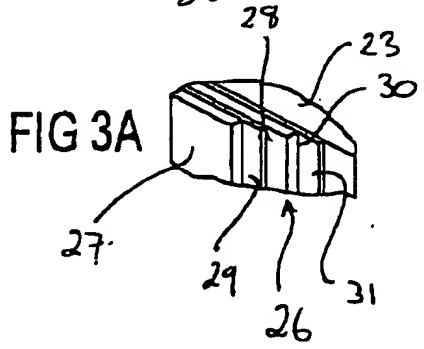


FIG 3A

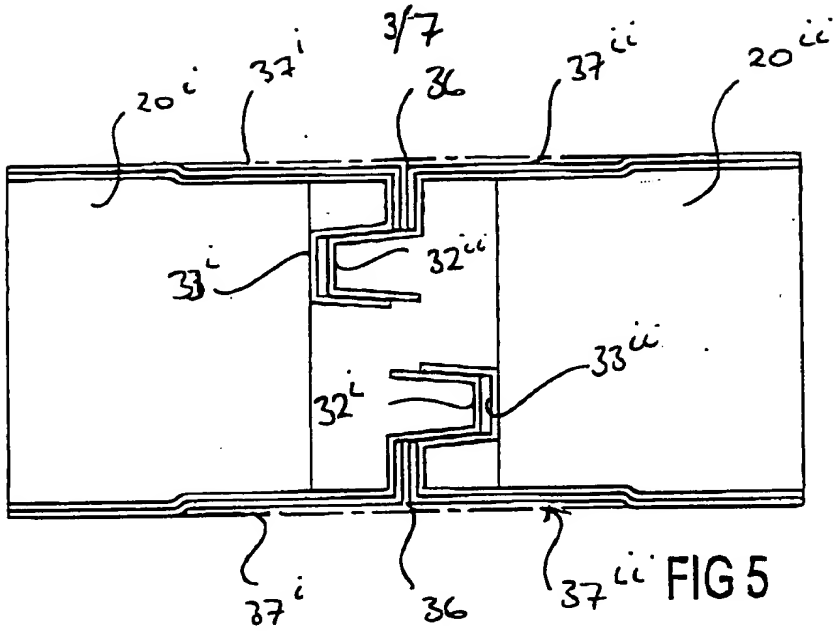
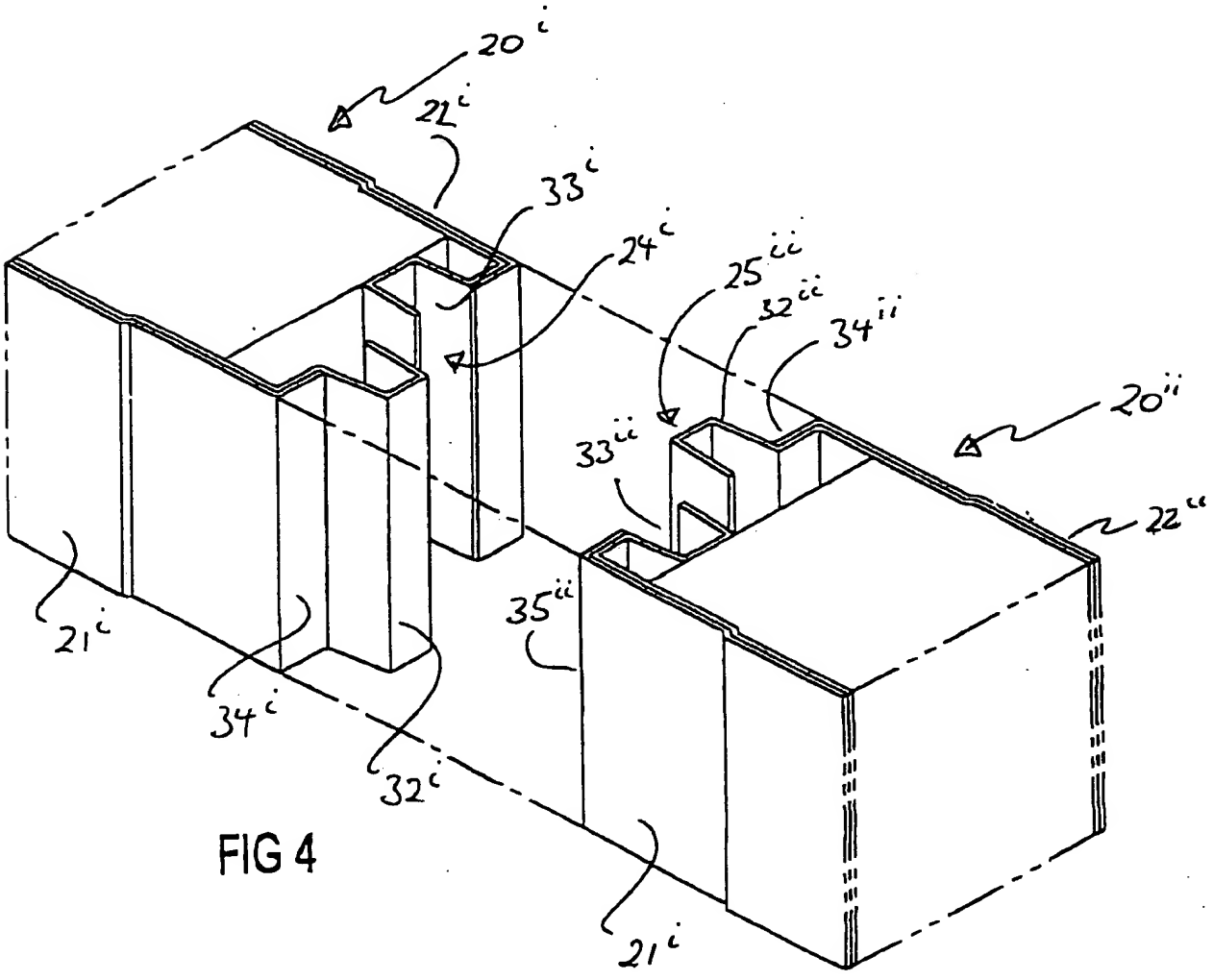

20i
37i
36
37ii
20ii
33i
32ii
32i
33ii
37i
36
37ii

FIG 5


20i
22i
33i
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25ii
32ii
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20ii
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34i
32i
21i

FIG 4

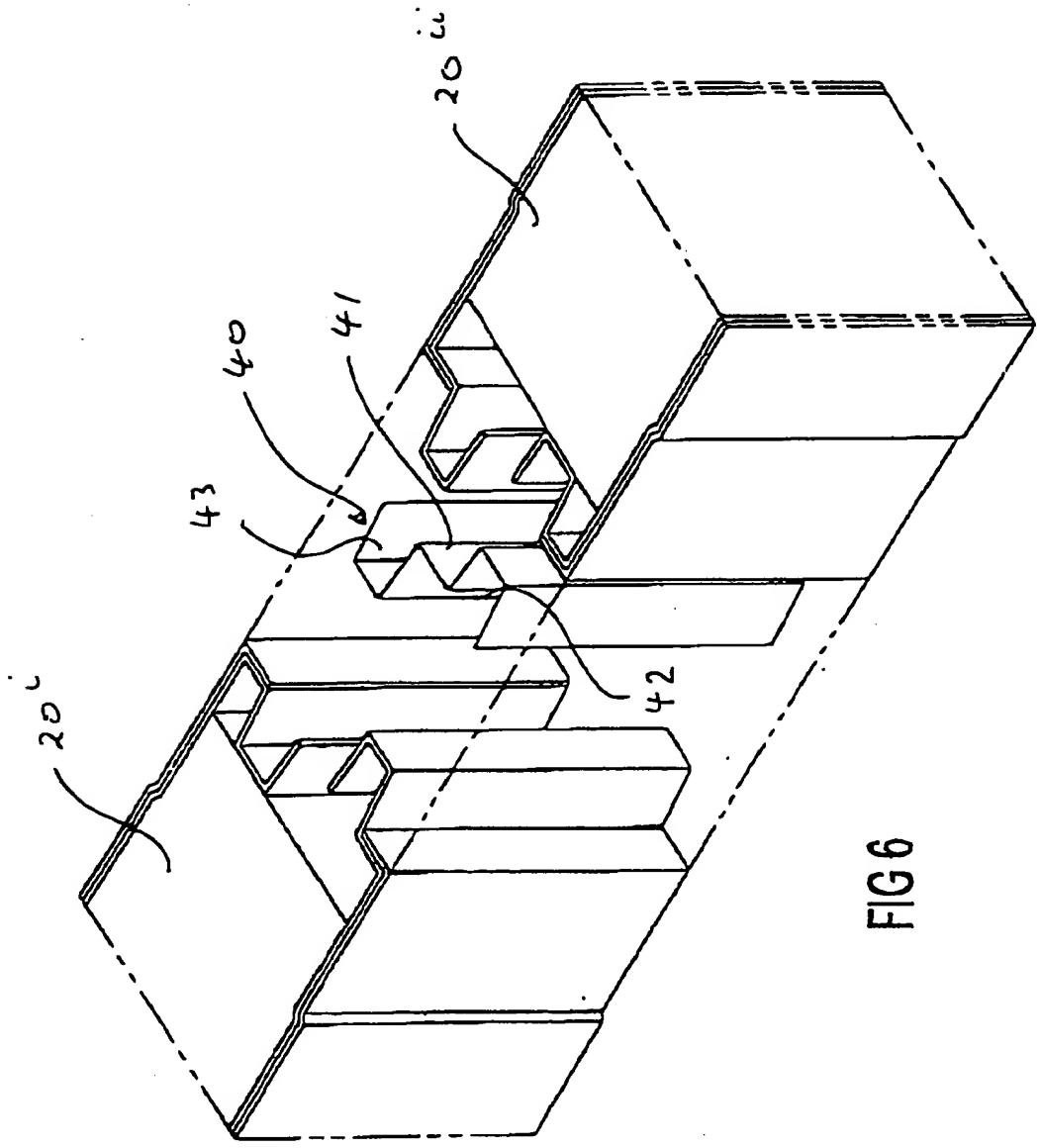

FIG 6

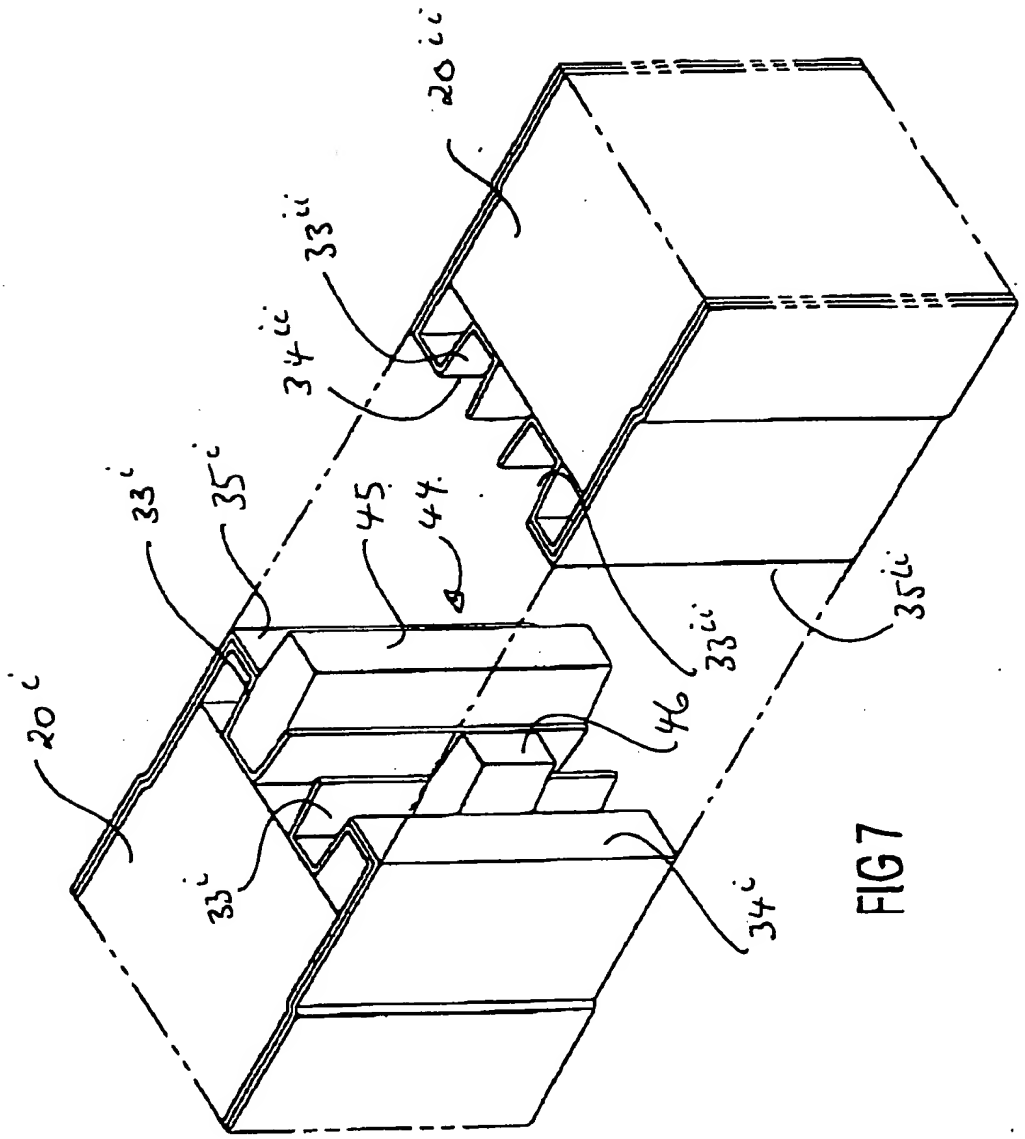

FIG 7

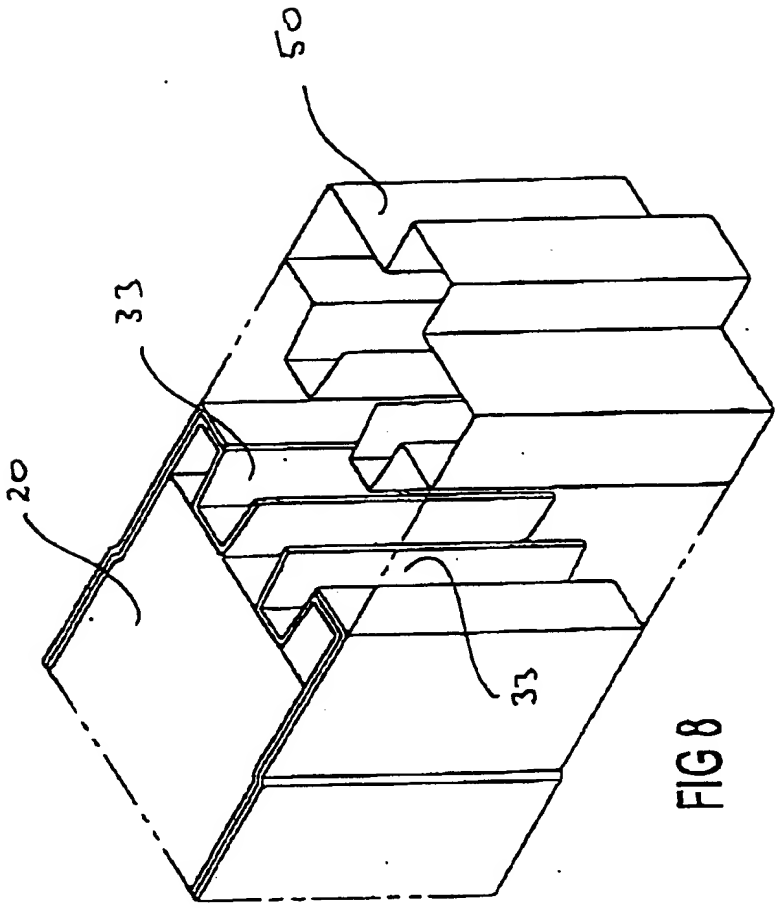

FIG 8

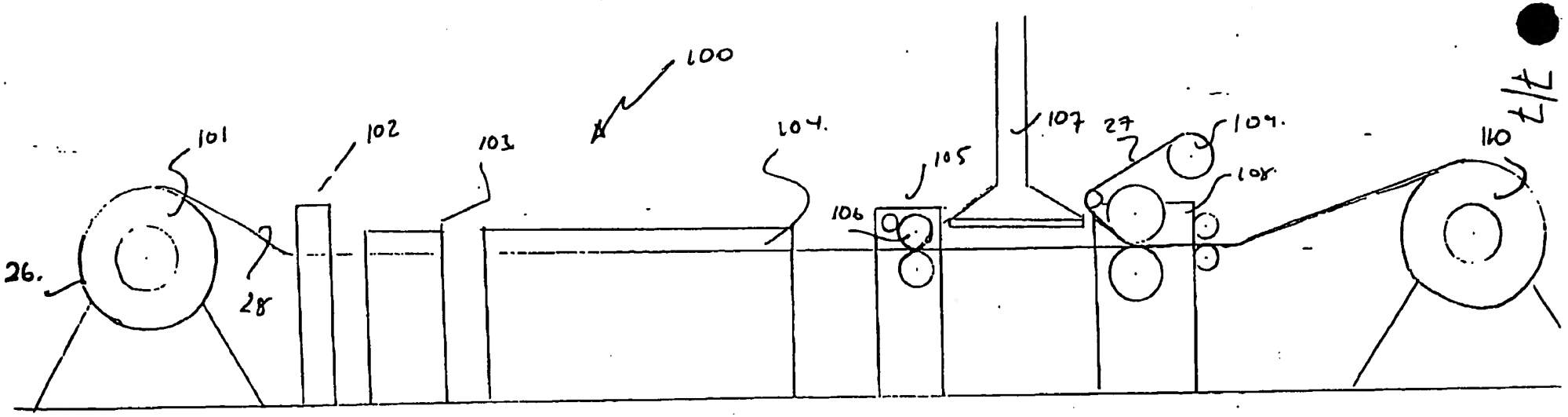

FIG 9.